NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**V**
Course Code:	**3EE201CC24**
Course Title:	**Electrical Power System Analysis**
Course Type:	**Core**
Year of Introduction:	**2024 – 25**

L	T	Practical component				C
		LPW	PW	W	S	
3	0	2	-	-	-	4

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. deduce the per unit diagram of the power network and its matrices (BL3)
2. apply different techniques for the load forecasting and load flow analysis of power system (BL3)
3. analyse the symmetrical and unsymmetrical faults for the power system network (BL4)
4. evaluate power system stability under various transient conditions of the power system (BL5)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Introduction and Per Unit Representation of Power System** Necessity and relevance of power system analysis in the present scenario, an overview of different power system analysis, the need of per unit system, impedance and reactance diagram.	**03**
Unit-II	**Load Forecasting** Importance of load forecasting, types of load forecasting, forecasting process, practical studies.	**03**
Unit-III	**Load Flow Analysis** Primitive network, construction of Y-Bus matrix, classification of Buses, load flow problem and its solution techniques, concept of static and dynamic load flow, static load flow equations, Gauss-Seidel method, Newton-Raphson method, Decoupled method, Fast Decoupled method, DC load flow method and recent trends in load flow studies.	**13**
Unit-IV	**Short Circuit Analysis** Need of short circuit studies, assumptions in fault analysis, Construction of Z-Bus matrix, fault analysis using Thevenin's theorem, symmetrical fault analysis, sequence components, sequence networks of power system, unsymmetrical fault calculations, analysis of open conductor faults, Bus impedance matrix method for analysis of unsymmetrical shunt faults.	**11**
Unit-V	**Stability Analysis** Importance of stability analysis, classification of power system stability, power angle characteristics, stability limits, dynamics of synchronous	**15**

machines, swing equation, synchronizing coefficient, equal area criterion and its applications, numerical solution of swing equation, multi-machine stability, factors affecting steady state and transient stability, the concept of RE integration and system stability, impact of e-mobility & charging point infrastructure.

Self-Study: The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

- John Grainger and W. D. Stevenson, *Power System Analysis*, McGraw Hill
- M. A. Pai, *Computer Techniques in Power System Analysis*, McGraw Hill
- G.W.Stagg and A.H.El-Abiad, *Computer Methods in Power System Analysis*, McGraw Hill
- D.P. Kothari and I. J. Nagrath, *Modern Power System analysis*, McGraw Hill
- A. Chakrabarti, M. L.Soni, U.S. Bhatnagar & P.V. Gupta, *Power System Engineering*, Dhanpat Rai Publishers
- J. Duncan Glover, Mulukutla S. Sarma, *Power System Analysis and Design*, Cengage Learning.
- B. R. Gupta, *Power System Analysis and Design*, S. Chand Publishers
- C. L. Wadhwa, *Electrical Power Systems*, New Age International Publishers
- Arthur R Bergen, Vijay Vittal, *Power System Analysis*, Pearson Education
- S. S. Vadhera, *Power System Analysis and Stability*, Khanna Publishers

Suggested List of Experiments: Laboratory work will be based on the above syllabus with a minimum 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of laboratory work.

Sr. No.	Name of Experiment	Hours
1.	Introduction to software used in electrical power systems and building a sample power system	2
2.	To perform the short-term load forecasting and predict the load	2
3.	To perform the long-term load forecasting and predict the load	2
4.	To develop a computer program to form the bus admittance matrix (Y Bus) of a power system	2
5.	To develop a computer program for load flow analysis using Gauss-Seidel method	2
6.	To perform and analyse the load flow using Newton-Raphson method	4
7.	To simulate and perform the power system fault analysis	2
8.	To simulate and analyse the transient stability of sample power system.	4
9.	To develop a computer program for transient stability analysis using a numerical method	2
10.	To perform different studies on standard benchmarks in power system	2